MS37 P01

Wave field Enhancement during Grazing Incidence X-ray Backscattering Diffraction Hakob (Akop) P. Bezirganyan[a], Siranush E. Bezirganyan,[b] Petros H. Bezirganyan (Jr.),[c] Hayk H. Bezirganyan (Jr.),[d] [a]*Department of Solid State Physics, Faculty of Physics, Yerevan State University, Yerevan, Armenia*. [b]*Department of Medical & Biological Physics, Yerevan State Medical University after Mkhitar Heratsi, Yerevan, Armenia.* [c]*Department of Computer Science, State Engineering University of Armenia, Yerevan, Armenia.* [d]*Faculty of Computer Science and Applied Mathematics, Yerevan State University, Yerevan, Armenia.*
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The growth of $Si_{1-\alpha-\beta}Ge_{\alpha}C_{\beta}/Si$ carbon containing films is not an easy task because of the high-mismatch between the silicon and carbon lattices, the low solubility of carbon in silicon and germanium, and the tendency of carbon to precipitate into β-polytype silicon carbide [1]. The same difficulties are arising during the epitaxial growth of silicon cap layer on the $Si_{1-\alpha-\beta}Ge_{\alpha}C_{\beta}$ layer because the substitutional carbon concentration between these two layers is depleted.
In purpose to avoid such difficulties, a model of a strain-compensated $Si/Si_{1-\alpha-\beta}Ge_{\alpha}C_{\beta}/Si$ heterostructure is proposed in the presented theoretical paper. X-ray diffracting lattice planes of silicon cap layer and strain-compensated $Si_{1-\alpha-\beta}Ge_{\alpha}C_{\beta}$ layer, which is epitaxially grown on the bulk relaxed silicon substrate, have the same value of the spacing period d_{hkl} along the growth surface. However, there exists a longitudinal shift between their spacing periods caused by the misfit dislocations. This paper concerns the non-destructive investigations of bicrystal-like model of heterostructure by the extremely sensitive grazing-angle incidence x-ray backscattering diffraction (GIXB) technique [2, 3]. The development of such non-destructive investigation method is in the focus of fundamental aspects of material research, crystal engineering etc.
We consider theoretically in presented paper an enhancement phenomena of the x-rays reflected from the mentioned heterojunction depending on the shift between the cap layer and substrate spacing periods. As an illustrative example we consider a GIXB by the (444) diffracting lattice planes of the heterostructure, which are normal to x-ray entrance surface. It is shown that the increase in the value of the space phase along the heterojunction's interface between silicon cap layer and strain-compensated $Si_{1-\alpha-\beta}Ge_{\alpha}C_{\beta}$ layer leads to essential enhancement of the reflectivity coefficient.

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MS37 P02

Optimal Thickness of Non-diffracting Subsurface Mirrors of X-Ray Optical Memory Siranush E. Bezirganyan[a], Hakob (Akop) P. Bezirganyan,[b] Petros H. Bezirganyan (Jr.),[c] Hayk H. Bezirganyan (Jr.),[d] [a]*Department of Medical & Biological Physics, Yerevan State Medical University after Mkhitar Heratsi, Yerevan, Armenia.* [b]*Department of Solid State Physics, Faculty of Physics, Yerevan State University, Yerevan, Armenia.* [c]*Department of Computer Science, State Engineering University of Armenia, Yerevan, Armenia.* [d]*Faculty of Computer Science and Applied Mathematics, Yerevan State University, Yerevan, Armenia.*
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X-ray optical memory (*X-ROM*) is a semiconductor wafer, in which the high-reflectivity x-ray mirrors are embedded. Data are encoded due to certain positions of these mirrors. The X-ray-based optical data storage devices e.g. could operate using the grazing-angle incidence x-ray backscattering diffraction (*GIXB*) technique [1-3]. Grazing-angle incident x-ray configuration allows the handling of data from very large surface area and, consequently, the data read-out speed is much faster than in optical data read-out systems (Fig.1):

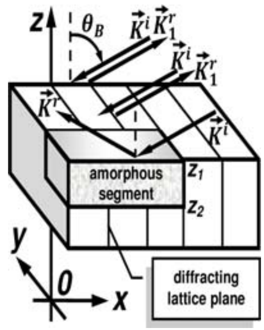

Fig.1. The *GIXB* by two-segment element of x-ray optical memory in the case of specular vacuum wave suppression mode. θ_B is kinematic Bragg angle, $T=(z_1-z_2)$ is the thickness of amorphous component generated in crystalline substrate.

According [3], the most part of x-ray wave field energy is back warded from the X-ROM's crystalline substrate caused by the x-ray specular (mirror) wave suppression phenomenon. Consequently, if the *GIXB* takes place in conditions of the specular vacuum wave suppression mode, then the reflected wave $\boldsymbol{K}^r$ (contrary to other existing x-ray diffraction methods) practically carries the information only about non-diffracting subsurface mirrors [4].
We consider in presented theoretical paper the effective depths of penetration of the non-homogeneous x-ray wave fields in crystalline substrate and amorphous segments of the X-ROM respectively, when the angle of incidence θ^i of the x-ray micro beam $\boldsymbol{K}^i$ is exactly satisfying the Bragg's Law, i.e. $\theta^i=\theta_B$, where θ_B is the Bragg angle. As a result, the condition is obtained for optimal thickness $T=(z_1-z_2)$ of the *X-ROM* amorphous reflecting domains (speckles).

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